

B. PHARM. SEMESTER-VI

601 T: PHARMACEUTICS -VIII (PHARMACEUTICAL TECHNOLOGY-II)

1. Microencapsulation: Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, co-accervation, multiorifice centrifugal, spray drying, spray congealing, polymerization complex emulsion, air suspension technique, coating pan and other techniques, evaluation of microcapsules.
2. Parenteral products:
 - a. Preformulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicles, and isotonicity.
 - b. Aseptic techniques: Sources of contamination and methods of prevention, design of aseptic area, laminar flow bench services and maintenance.
 - c. Formulation details, containers and closures and their selection.
 - d. Pre-filling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization and preparation of sterile powders, equipments for large-scale manufacture and evaluation of parenteral products.
3. Design, development, production and evaluation of controlled released formulations.
4. Novel drug delivery systems: Drawbacks and deficiencies of conventional drug delivery systems, introduction to novel drug delivery systems, e.g., transdermal drug delivery patches, ocular inserts and osmotic pumps, introduction of liposomes and prodrugs.
5. Ophthalmic preparations: Requirements, formulation and methods of preparations, containers, and evaluation.

601 P: PHARMACEUTICS -VIII (PHARMACEUTICAL TECHNOLOGY-II)

1. Prepare microencapsulation of the given drug using phase separation method and evaluate.
2. Prepare microencapsulation of the given drug using co-acervation method and evaluate.
3. Prepare microencapsulation of the given drug using multiorifice method and evaluate.
4. Perform filling, sealing and evaluation of parenteral preparation.

5. Prepare and evaluate ophthalmic preparation.
6. Prepare and evaluate water for injection.
7. Prepare sterile powder by lyophilization technique.
8. Evaluate marketed controlled release formulation.

BOOKS RECOMMENDED

1. Turco, S., Sterile Dosage Form, Williams & Wilkins, USA.
2. Gennaro, A.R., Remington's The Science and practice of Pharmacy, Lippincott, Williams & Wilkins, Philadelphia.
3. Lachman, L., Lieberman, H.A. and Kanig, J.L., The Theory and Practice of Industrial Pharmacy, Varghese Publishing House, Mumbai.
4. Rawlins, E.A. (Ed.), Bentley's Textbook of Pharmaceutics, Bailliere Tindall, London.
5. Pharmacopoeia of India, Ministry of Health and Family Welfare, Govt. of India, New Delhi.
6. Avis, K.E., Lachman, L. and Lieberman, H.A., Pharmaceutical Dosage Forms- Parenteral Medication Vol. 1-2, Marcel Dekker, New York.
7. Banker G.S. and Rhodes C.T., Modern Pharmaceutics, Marcell Decker Inc., New York.
8. Bean, H.S., Beckett, A.H. and Carless, J.E., Advances in Pharmaceutical Sciences, Academic Press Inc, London.

602 T: PHARMACEUTICAL BIOTECHNOLOGY

1. Introduction, historical perspective, genomics, proteonomics and other biotechnology related techniques, scope and future of pharmaceutical biotechnology.
2. Enzyme immobilization: Introduction, factor affecting enzyme kinetics, Technique of immobilization of enzymes, immobilization of plant and bacterial cell, study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase, amylase and protease, therapeutic applications of enzyme immobilization.
3. rDNA technology: Introduction, transformation, conjugation, transduction, protoplast fusion and plasmid mediated gene transfer, gene cloning including enzymes acting on DNA, cloning vectors, insertion of target DNA into vector, transformation and growth of

cells, selection of recombinant clones and their applications, techniques of genetic engineering, study of drugs produced by biotechnology such as activase, humulin, humantrope, HB etc.

4. Vaccine technology: Introduction, immunological principles, conventional vaccines, modern vaccine technologies, development of hybridoma for monoclonal antibodies and monoclonal antibody based pharmaceuticals, pharmaceutical considerations of vaccines.
5. Fermentation: Introduction to fermentation, fermenters and types of fermenters, factors affecting design of fermenter, the fermentation process and its optimization with special reference to ethyl alcohol, riboflavin, cephalosporin and ascorbic acid.
6. Production and downstream processing of biotech products: Introduction, production, downstream processing, issues to consider in production and purification of proteins, formulation of biotech products and its biopharmaceutical considerations, pharmacokinetics and pharmacodynamics of peptide and protein drugs.
7. Plant tissue culture: Introduction, laboratory requirements, cellular totipotency, types of cultures, protoplast fusion and somatic hybridization, transgenic plants and application of transgenic plants, cryopreservation and application of PTC in Pharmacy.

602 P: PHARMACEUTICAL BIOTECHNOLOGY

1. Study of tools and terminology used in biotechnology Lab
2. Compare the bactericidal effect of dry heat and moist heat sterilization.
3. Perform comparative study of different tissue sterilization procedures.
4. Study of the immobilization of enzymes in Ca/Na –alginate.
5. Immobilize the activity of α -amylase by cross-linking and determine the % entrapment efficiency.
6. Study of the immobilization of bacterial cell in Ca/Na –alginate.
7. Isolate RNA from baker yeast.
8. Isolate DNA from onion/ cauliflower.
9. Study of the Ag-Ab reaction by single diffusion method.
10. Study of the Ag-Ab reaction by double diffusion method.
11. Study of the formation of indole by degradation of proteins by bacteria.
12. Study of the presence of catalase activity by fermentation.

13. Study of the production of riboflavin by fermentation.
14. Study of the production of ethyl alcohol by fermentation
15. Develop callus culture from carrot cambium explants.
16. Study of the plant cell growth pattern and measure the cell growth in callus culture.
17. Study of the plant cell growth pattern & measure the cell growth in suspension culture.
18. Counting plant cells using haemocytometer.
19. Study of the *agrobacterium tumifaciens* mediated transformation in plant tissues.
20. Study of the *agrobacterium rhizogenes* mediated transformation in plant tissues

BOOKS RECOMMENDED

1. Vyas S.P. and Dixit V.K., Pharmaceutical Biotechnology, CBS Publishers and Distributors Pvt. Ltd., New Delhi.
2. Walsh, G., Biopharmaceuticals: Biochemistry and Biotechnology, John Wiley & Sons Ltd., England.
3. Daan J.A.C. & Robert D.S., Pharmaceutical Biotechnology, Taylor & Francis Group.
4. Kokate C.R., Pharmaceutical Biotechnology Fundamentals & Applications, Nirali Prakashan, Pune.
5. Reed, G., Prescott & Dunn: Industrial Microbiology, CBS Publishers and Distributors Pvt. Ltd, New Delhi.
6. Patel A.H., Industrial Microbiology, Macmillan India Ltd., New Delhi.
7. Khan, I. and Atiya, K. Emerging Trends in Bioinformatics, Ukaaz Publication, Hyderabad, India.
8. Thakur I. S., Industrial Biotechnology: Problems and Remedies, I.K. International Pvt. Ltd., New Delhi.
9. Gaud R.S., Gupta G.D. and Gokhale S.B., Practical Biotechnology, Nirali Prakashan, Pune.
10. Giri C.C., Giri A., Plant Biotechnology Practical Manuals, I.K. International Pvt. Ltd., New Delhi.

603 T: PHARMACEUTICAL CHEMISTRY-VI (MEDICINAL CHEMISTRY-II)

Classification, synthesis of selective drugs, Structure-activity relationship, Pharmacological/Biochemical mechanism of action, Therapeutic uses of following category of agents: (special emphasis should be given to specified drugs)

1. Drugs affecting central nervous system:

General Anesthetics: Thiopental sodium, Ketamine Hydrochloride, Methohexital Sodium, Paraldehyde and Tribromoethanol.

Sedatives and Hypnotics: phenobarbital, methylphenobarbital, allobarbital, butobarbitone, amobarbital, hexobarbital, pentobarbital sodium, cyclobarbital. Nitrazepam and Glutethimide.

Antiepileptic or anticonvulsant agents: Phenytoin Sodium, Trimethadione, Phensuximide, Ethosuximide, Valproic Acid and Primidone.

Opioid Analgesics: Morphine, Diamorphine Hydrochloride, Codeine, Levorphanol Tartrate, Dextromethorphan Hydrobromide, Pentazocine, Pethidine Hydrochloride, Fentanyl Citrate, Methadone Hydrochloride, Nalorphine Hydrochloride, and Naloxone Hydrochloride.

Antiparkinsonian agents and Spasmolytic agents: Biperiden Hydrochloride, Trihexyphenidyl Hydrochloride, Benztropine Mesylate, Orphenadrine Citrate, Chlorphenoxamine Hydrochloride and Levodopa.

CNS Stimulants: Caffeine, Theobromine, Nikethamide, Etamivan, Pentetrazol, Bemegride, and Methylphenidate.

Psychopharmacological Agents: Neuroleptics, antidepressant and anxiolytic agents (Nikethamide, Doxapram Hydrochloride, Dextroamphetamine Sulphate, Pentylenetetrazole, Amitriptyline Hydrochloride, Imipramine Hydrochloride, Doxepin Hydrochloride, Phenelzidine, Tetrahydrocannabinol, Chlorpromazine Hydrochloride, Trifluoperazine, Thioridazine Hydrochloride, Prochlorperazine Maleate, Trifluoperazine Hydrochloride, Thiothixene, Haloperidol, Droperidol, Resperidone, Chlordiazepoxide, Diazepam, Oxazepam, Lorazepam, Halazepam, Flurazepam and Alprazolam).

2. Drugs affecting Hormonal System:

a. Thyroid hormones and Antithyroid agents: Biosynthesis of thyroid hormones

Propylthiouracil, Methimazole, Carbimazole and I^{131} .

- b. Insulin and Oral Hypoglycaemic agents: Chemistry of Insulin and its preparations (Chlorpropamide, Tolbutamide, Glimepride, Glipizide, Rosiglitazone, Pioglitazone, Metformin, Phenformin, Acarbose, Miglitol, Repaglinide).
- c. Steroidal agents: Steroidal nomenclature, Stereochemistry, Biosynthesis, Interconversions of androgens, estrogens, progesterones and adrenocorticoids. Androsterone, testosterone, estrone, estriol, estradiol, diethylstilbesterol, progesterone, cortisone, prednisolone and Dexamethasone.

Drugs affecting Haematopietic System: Antithrombotic, Thrombolytic and Anticoagulant agents (Warfarin Sodium, Protamine Sulphate, Dicoumarol, Phenindione and Anisindione).

4. Chemistry and physiological importance of water & lipid soluble Vitamins.

603 P: PHARMACEUTICAL CHEMISTRY-VI (MEDICINAL CHEMISTRY-II)

The practical includes synthesis of selected medicinally important compounds, physico-chemical characterization including melting point, solubility, thin layer chromatography, UV and IR spectrum.

1. Synthesis and characterization of Diphenyl Hydantoin.
2. Synthesis and characterization of Chalcone.
3. Synthesis and characterization of 4-Methyl Coumarin.
4. Synthesis and characterization of Flavones.
5. Synthesis and characterization of Phenindione.
6. Synthesis and characterization of Nikethamide.
7. Synthesis and characterization of Levodopa.
8. Synthesis and characterization of Phenothiazine.

BOOKS RECOMMENDED

1. Wolff, M.E. Ed., Burger's Medicinal Chemistry, John Wiley and Sons, New York.
2. Delagado, J.N. and Remers, W.A.R, Wilson and Giswold's Text Book of Organic, Medicinal and Pharmaceutical Chemistry, J. Lippincott Co., Philadelphia.
3. Nogrady, T., Medicinal Chemistry-A Biochemical Approach, Oxford University Press,

New York, Oxford.

4. Kar, A., Medicinal Chemistry, Willey Eastern Ltd., New Delhi.
5. Patrick, G., An Introduction to Medicinal Chemistry, Scientific Distributors, Mumbai.
6. Thomas, G., Introduction to Medicinal Chemistry, CBS Publishers and Distributors, New Delhi.
7. Foye, W.O., Principles of Medicinal Chemistry, Lea and Febiger, Philadelphia.
8. Singh, H., Kapoor, V.K. Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan New Delhi.
9. Lednicer, D., The Organic Chemistry of Drug Synthesis, Volume 1-6, John Wiley and sons Inc., New York.
10. Pandya, S.N., Textbook of Medicinal Chemistry, SG Publisher, Varanasi.

604 T: PHARMACEUTICS -IX (PACKAGING TECHNOLOGY)

1. Packaging of pharmaceutical dosage form: Introduction, Definition and function, Regulatory requirements, Nature of package evaluation, Types of packaging.
2. Packaging of solid oral dosage form: Scope, Packaging, stability and shelf life of containers and closures, Unit dosage packaging.
3. Packaging of semisolids and topical: Scope, regulatory requirements, containers and closures.
4. Glass packaging materials: Containers and closures, Glass as a packaging material, composition and types.
5. Plastic packaging materials: Containers and closures, introduction, classification of plastic materials.
6. Metal packaging materials: Containers and closures, Introduction, Modern packaging metal, Tinsplate and associated materials aluminium.
7. Tamper-resistant packaging: Introduction, Film wrapper, Blister package, Strip package, Bubble pack, foil, pouches, bottle seals and tape seals.
8. Child resistant package.

BOOKS RECOMMENDED

1. Dean, D.A., Evans, E.R., Hall, I.H., Pharmaceutical Packaging Technology, London and

New York.

2. Lachman, L., Lieberman, H.A. and Kanig, J.L., The Theory and Practice of Industrial Pharmacy, Varghese Publishing House, Mumbai.
3. Banker G. S. and Rhodes C. T., Modern Pharmaceutics Marcel Dekker Inc.
4. Harburn Kenneth, Quality Control of Packaging materials in the Pharmaceutical Industry.
5. Brody, A. L. and Marsh, K.S., Encyclopedia of Packaging Technology, John Wiley and sons, New York.

605T: PHARMACOLOGY-II

1. Pathophysiology of CNS diseases and pharmacology of drugs used to treat them
 - a. Neurohumoral transmission in CNS: Cholinergic pathways, Dopaminergic pathways, Serotonergic pathways, Noradrenergic pathways.
 - b. General anesthetics, alcohol and disulfiram.
 - c. Hypnotics, sedatives, anti-anxiety agents, and centrally acting muscle relaxants.
 - d. Psychopharmacological agents: Antipsychotics, Antidepressants, Anti-manics and Hallucinogens.
 - e. Antiepileptic drugs
 - f. Narcotic analgesics and antagonists
 - g. Drugs used in neurodegenerative diseases: Parkinson's disease and Alzheimer's disease
 - h. Drug addiction and drug abuse: Alcohol, Nicotine and Cannabis.
 - i. CNS stimulants
2. Pathophysiology of diseases of endocrine system and pharmacology of drugs used for their treatment.
 - a. Hypothalamic and pituitary hormones.
 - b. Thyroid hormones and anti thyroid drugs.
 - c. Insulin, oral hypoglycemic agents and glucagons.
 - d. Corticosteroids.
 - e. Androgens, anabolic steroids and drugs for erectile dysfunction.
 - f. Estrogens, progestins and oral contraceptives.
 - g. Oxytocin and drugs acting on the uterus.

- h. Parathormone, calcitonin and vitamin D, ACTH and corticosteroids.
- 3. Drug acting on Haematopoietic system
 - a. Haematinics (pathophysiology of anaemia)
 - b. Anticoagulants
 - c. Fibrinolytic and antiplatelet drugs
 - d. Blood and plasma volume expanders.

605P: PHARMACOLOGY-II

1. Study of the effect of given drug on righting reflex (hypnosis) in mice.
2. Study of the effects of CNS depressants using cornea and pinna reflex test.
3. Study of the effects of given drug on locomotor activity of mice using Actophotometer.
4. Study of the neuromuscular effect of given drug using Rotarod apparatus.
5. Study of anticonvulsant effect of some drugs using maximum electroshock method and chemical-induced convulsion method.
6. Study of anti-anxiety effect of some drugs using elevated plus maze test or social interaction test or novelty suppressed feeding test in rodents.
7. Evaluate hypnotic activity of a drug by employing potentiation of thiopental induced sleeping time paradigm.
8. Record the concentration response curve of oxytocin using rat uterus preparation.
9. Study of the effect of oral hypoglycemic agents in diabetic rodents.
10. Study of the effect of thyroid hormones on the tensile strength of connective tissues in rats.
11. Study of the effect of growth hormone on the weight gain in female rats.
12. Determine the effect of anticoagulants by subaqueous tail bleeding time method in rodents.
13. Study of the antidepressant effect of given drug in mice using a) Tail suspension test and b) Despair swim test
14. Study of the anxiolytic activity of given drug in mice using light and dark box model.
15. Study of the anxiolytic effect of given drug in mice using mirrored chambered apparatus.

BOOKS RECOMMENDED

1. Herfindal, E.T., Gourley, D.R., Textbook of therapeutics Drug and disease management, Lippincott Williams and Wilkins, Baltimore.
2. Brunton, L.L., Lazo, J.S., Parker, K.L., Goodman and Gilman's The Pharmacological Basis of Therapeutics, The McGraw Hill Companies, USA.
3. Kumar, V., Abbas, A.K., Fausto, N., Robbins and Cotran Pathologic basis of disease, Saunders, Pennsylvania.
4. Barar, F.S.K., Essentials of therapeutics, S. Chand and Company (P) Ltd. New Delhi:
5. Satoskar, R.S., Bhandarkar, S.D., Rege, N.N., Pharmacology and Pharmacotherapeutics, Popular Prakashan, Mumbai.
6. Seth, S.D., Textbook of Pharmacology, Elsevier, New Delhi.
7. Tripathi, K.D., Essentials of Medical Pharmacology, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.
8. Mycek M.J., Haney, R.A., Champe, P.C., Lippincott's illustrated reviews: Pharmacology, Lippincott Williams and Wilkins, Baltimore.
9. Rang, H.P., Dale, M.M., Riter, J.M. and Flower, R.J., Rang and Dale's Pharmacology, Churchill Livingstone, Philadelphia.
10. Katzung, B.G., Basic and clinical pharmacology, The McGraw Hill Companies, USA
11. McKim, W.A., Drugs and Behavior: An Introduction to Behavioral Pharmacology, Prentice Hall, London.
12. Sharma, S.C., Understanding human disease "Pathophysiology of major human diseases", G.S Sharma, Shahdra, Delhi.

606 P: COMMUNICATION SKILLS & PERSONALITY DEVELOPMENT-VI

1. Public speaking and presentation skills: Characteristics, types, modes of delivery elements of high impact presentation, preparation of power-point and overhead projector presentations, video conferencing.
2. Group discussion, debate and extempore: Structure, strategies, dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency, coherence, team work in a group discussion, mock group discussion (GD). (Seminars on related topics)

BOOKS RECOMMENDED

1. Huckin, T.N. and Olsen, L.A., Technical Writing and Professional Communication, McGraw-Hill, Inc., New Delhi.
2. Gerson, S.J. and Gerson, S.M., Technical Writing, Pearson Education Asia, Hong Kong.
3. Esenberg, A., A Beginner's Guide to Technical Communication, McGraw-Hill, New Delhi.
4. Rutherford, A.J. Basic Communication Skills for Technology, Pearson Education Asia, Hong Kong.
5. Lesikar, R.V. Peritt, J.D. and Flatley, M.E., Lesikar's Basic Business Communication, McGraw-Hill, New Delhi.
6. Bovee, C.L., Thill, J.V. and Schatzman, B., Business Communication Today, Pearson Education Asia, Hong Kong.
7. Ober, S., Contemporary Business Communication, Houghton Mifflin Company, Wiley-Dreamtech, New York.
8. Sharma, R.C. and Mohan, K., Business Correspondence and Report Writing, Tata McGraw-Hill, New Delhi.